DETAILED ACTION

Drawings

1. The drawings were received on May 18, 2009. These drawings are disapproved.

The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the subject matters that the field plate is on the insulation layer which in turn is above the gate electrode and that the field plate is connected to the gate electrode as recited in claims 1 and 13 (which would require disconnection between the source electrode and the field plate) must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Furthermore, it is not clear what numeral 37 in Fig. 1 definitely refers to, as there is no explanation about it either in the drawing or in the specification.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as “amended.” If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering

of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 1-18 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claims 1 and 13 each recite the subject matters that the field plate is on the insulation layer which in turn is above the gate electrode and that the field plate is connected to the gate electrode. However, the disclosure lacks an adequate description regarding these subject matters. It is not clear where and/or how the gate electrode and the field plate could be connected together, given that the gate electrode and the field plate are formed of different layers with the recited insulation layer therebetween.

Claims 1 and 14 each recite the subject matter that the recited field plate is formed so as to form a linear lateral electric field distribution in the lateral drift region. However, such subject matter appears to be inconsistent with the fact that a (substantially) linear voltage/potential distribution across the field plate is naturally formed in the instant invention (see lines 7-14 on page 4 of the instant specification; as further evidenced in claims 11 and 13), given that: such linear voltage/potential distribution will inherently tend to cause the voltage/potential distribution in the nearby lateral drift region also to be linear; and the voltage (or potential) and the field cannot both be simultaneously linear in any region, which is because:

The field (E) is a derivative of the voltage (or potential; V), i.e., $E = -dV/dX$, as readily evidenced in Reference U (particularly see Eqs. 7 and/or 17a therein). So, if V is linear (such as $V = aX$), the E has to be a constant ($-a$; a linear distribution is not always a constant). Or, if E is linear (such as $E = bX$), then V must be nonlinear ($-0.5bX^2$).

Accordingly, the subject matters as recited or implicated in the claims that recite the lateral electric field distribution in the lateral drift region can also be linear when the voltage/potential distribution across the nearby field plate is linear in the instant invention appear to be inconsistent with the general physics as provided above.

Claims 11 recites the subject matters that “said metallic regions in the field plate is connected to said source region and the remaining ones of said metallic regions are capacitively coupled to the first one of said metallic regions to linearly distribute a voltage at the source region across the field plate.” However, the original disclosure lacks an adequate description regarding these subject matters, as it is not clear how the

voltage at the source region across the field plate could be linearly distributed, given that there is a biasing voltage/potential of the gate electrode (36) on the path between the source region (28) and the field plate region (52b) and/or between the source region (28) and the drain region (34); and, such a biasing voltage/potential of the gate electrode (36) would naturally cause a nonlinear disturbance to the voltage at the source region across the field plate.

Claims 17 and 18 recites the subject matter that the dopants arranged with doping gradient in the lateral drift region generate the linear lateral electric field distribution in the lateral drift region. However, full support cannot be found for it in the original disclosure, as the original disclosure never discloses that the dopants themselves arranged with doping gradient in the lateral drift region could generate any lateral electric field distribution in the lateral drift region, given that it is the electrodes and/or field plates that can directly generate a field in the drift region; and/or, it never discloses that the field in the drift region generated by the dopants could be linear.

4. Claims 5 and 17 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 5 recites the term of “another dielectric layer”, but fails to clarify: its relationship with the “insulation layer” already defined in claim 1; and/or whether the two are a same layer or different layers.

Claim 17 recites the subject matter that the dopants arranged with doping gradient in the lateral drift region generates the linear lateral electric field distribution in the lateral drift region; but it fail to clarify what is the feature that is definitely responsible for the generation of the recited linear field in the drift region, given that in claim 1 it is already defined that it is the recited field plate that is responsible for the generation of the recited linear field in the drift region.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 1-18, insofar as being in compliance with 35 U.S.C. 112, are rejected under 35 U.S.C. 103(a) as obvious over Letavic (Letavic et al., US 6,127,703) in view of Nakagawa (US 4,614,959; of record), or in the alternative, over Nakagawa in view of Letavic.

Letavic discloses a lateral thin-film Silicon-On-Insulator (SOI) device (Fig. 1), comprising: a semiconductor substrate (22), a buried insulating layer (24) on said substrate, and a lateral MOS transistor device in an SOI layer (26) on said buried insulating layer and having a source region (28; such as p type) of a first type conductivity formed in a body region (30; such as n type) of a second type conductivity, a lateral drift region (32) of a second type conductivity adjacent said body region, a

drain region (34) of said first type conductivity and laterally spaced apart from said body region by the lateral drift region; a gate electrode (36) insulated from said body region and drift region by an insulation region (an underlying portion of 38), an insulation lager (an upper portion of 38) on and laterally adjacent to the gate electrode.

Although Letavic does not expressly disclose that the device can further include a field plate comprising a first layer having plural laterally separated metallic regions, one of ordinary skill in the art would readily recognize that such field plate can be desirably formed so as to improve high voltage performance, as evidenced in Nakagawa (Fig. 10). In Nakagawa, the field plate (6', 13', 7') is on the insulation layer (8') and is connected to the source region and extending substantially over the surface of the substrate, wherein such field plate comprises a first layer of plural metallic regions (6', 13', 7') which are isolated laterally from one another by substantially same-sized spaces (filled with portions of the dielectric layer 8"), thus voltage (or potential) distribution across the field plate (from the end pieces 6' to the end piece 7') is inherently substantially linear, in a manner substantially same as that in the instant invention.

Therefore, it would have been obvious to one of the ordinary skill in the art at the time the invention was made to incorporate the field plate of Nakagawa into the device of Letavic, so that a device with improved high voltage performance would be obtained.

Or, in the alternative, it would also have been obvious to one of the ordinary skill in the art at the time the invention was made to incorporate the SOI-based device

structure of Letavic into the device of Nakagawa, so that a high voltage device on desired SOI substrate would be obtained.

And, with the above field plate being formed in the above collectively taught device, the electric field in the underlying and nearby lateral drift region therein would have a lateral distribution that would be naturally substantially same as whatever the distribution is in the instant invention, since the spaces that laterally separate the plural metallic regions in the first layer of the above field plate are substantially same in size, inherently causing the voltage (or potential) distribution across the field plate (from the end pieces 6' to the end piece 7') to be substantially linear, in a manner substantially same as that in the instant invention.

Regarding claims 3-5, it is further noted that the field plate of Nakagawa further comprises another layer of plural metallic regions (12') located above the spaces between the metallic regions in the first layer, laterally isolated from one another, and isolated from the metallic regions of said first layer by the dielectric layer (8").

Regarding claims 4 and 5, it is further noted, it is art known that the dielectric layer can be formed of a silicon-rich nitride layer as to increase the breakdown voltage, as readily evidenced in the prior art such as William (William et al., US 5,374,843; see col. 11, line 67, through col. 12, line 29).

Regarding claims 6-8, 15, 17 and 18, it is further noted that the drift region in the device of Letavic has the linearly-graded charge profile. And, regarding claims 17 and 18, it is further noted that the electric field in the underlying and nearby lateral drift region in the above collectively taught device would have a lateral distribution that would

be naturally substantially same as whatever the distribution is in the instant invention, in a manner substantially same as that in the instant invention, since they would both have the substantially same field plate and/or the substantially same dopant distribution therein.

Regarding claim 10, it is further noted that it is art known that the polarity of a semiconductor device can be readily reversed so as to obtained a device with desired opposite polarity.

Response to Arguments

7. Applicant's arguments filed on 05/18/2009 have been fully considered but they are not persuasive.

With respect to applicant's arguments against the "112, 1st" rejection, it is noted that the voltage (or potential) and the field cannot both be simultaneously linear in any region, as the field (E) is a derivative of the voltage (or potential; V), i.e., E = -dV/dX, as readily evidenced in Reference U (particularly see Eqs. 7 and/or 17a therein). Such relation is guided by general physics, which is universal, and Applicant fails to provide any adequate evidence to show why such general physics defining the relationship between the voltage (or potential) and the field would not be applicable to the instant invention.

Also, applicant fails to provide any adequate evidence to show why and/or how the voltage at the source region (which is formed inside the substrate) across the field plate could be linearly distributed, given that the required biasing voltage/potential of the

gate electrode (36) which is between the field plate and the substrate would naturally cause a nonlinear disturbance to the voltage at the source region across the field plate.

Regarding applicant's arguments against the obviousness rejection, it is noted that the device collectively taught by Letavic and Nakagawa would naturally result in the instant invention, and the electric field in the underlying and nearby lateral drift region in the above collectively taught device would have a lateral distribution that would be naturally substantially same as whatever the distribution is in the instant invention, in a manner substantially same as that in the instant invention, since the collectively taught device would have the substantially same field plate and/or the substantially same dopant distribution therein as that in the instant invention. Furthermore, it is noted that, for a field plate such as the one from Nakagawa, the voltage (or potential) distribution across the field plate (at least from the inner edge of the end piece 6' to the inner edge of the end piece 7') is inherently substantially linear, in a manner substantially same as that in the instant invention, since such field plate comprises a first layer of plural metallic regions (6', 13', 7') which are isolated laterally from one another by substantially same-sized spaces (the spaces that are filled with portions of the dielectric layer 8"), regardless whether the end pieces (such as 6' and 7') may have different sizes from that of the center pieces (such as 13'). It is especially true here, given that even in the instant invention (such as that shown in Fig. 1) the end pieces (such as the source/drain electrodes 52a and 44') also have different sizes from that of the center pieces (such as 52b).

Responses to applicant's other arguments have been fully incorporated into the claim rejections set forth above in this office action.

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Reference U is cited as being related to the general physics defining the relationship between voltage (or potential) and field.

9. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shouxiang Hu whose telephone number is 571-272-

1654. The examiner can normally be reached on Monday through Friday, 8:30 AM to 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Lynne Gurley can be reached on 571-272-1670. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Shouxiang Hu/
Primary Examiner, Art Unit 2811